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Estimating Accidents Using TRANSIMS

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Christopher L. Barrett

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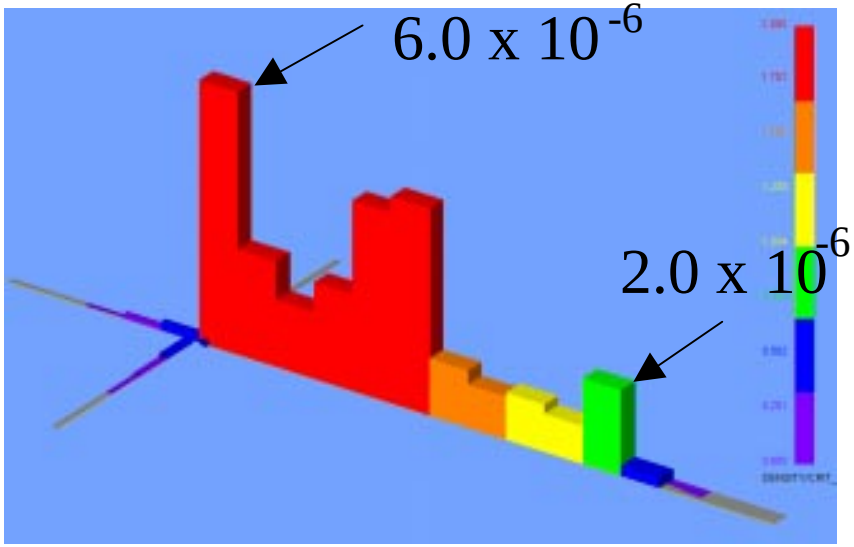
Our Goal

- Fact : TRANSIMS is collision-free.
- Intuition : Use the rare hard decelerations that occur to avoid collisions to estimate probability distributions of accidents in time and space.
- Goal
  - Estimate likelihood of accidents in a given network using TRANSIMS.
  - Reduce data requirements as much as possible.

Interpretation of our results

- Method provides relative likelihood of accidents distributed in a whole network and in time.



- Results can be used as relative safety measures in a network.
- Regional accident field data can be used to give a scaling constant to estimate the likelihood of accidents.

Basic Approach

- If a vehicle cannot "decelerate" enough, there will be a collision.
- Types of multi-vehicle accidents depicted:
  - rear-end
  - lane-changing
  - intersection or junction

  → 61 % of all accidents, and 89 % of all multi-vehicle accidents

Overview of Our Procedure

1 Find all "deceleration events."

2 Categorize them by type and by braking power (V*D).

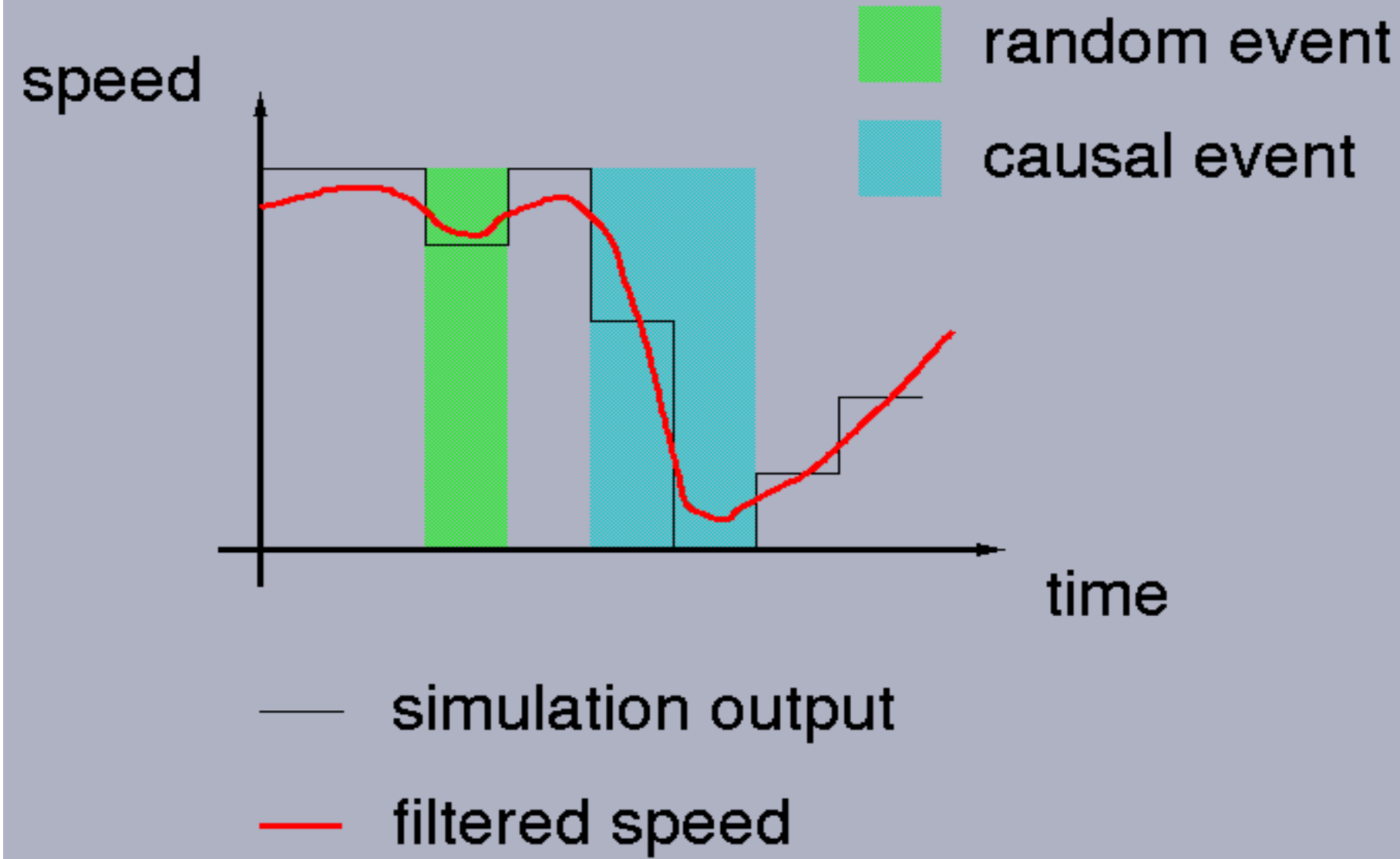
3 Assign the probability of an accident for each deceleration event.

4 Calculate the expected number of accidents in a given location and a given time interval.

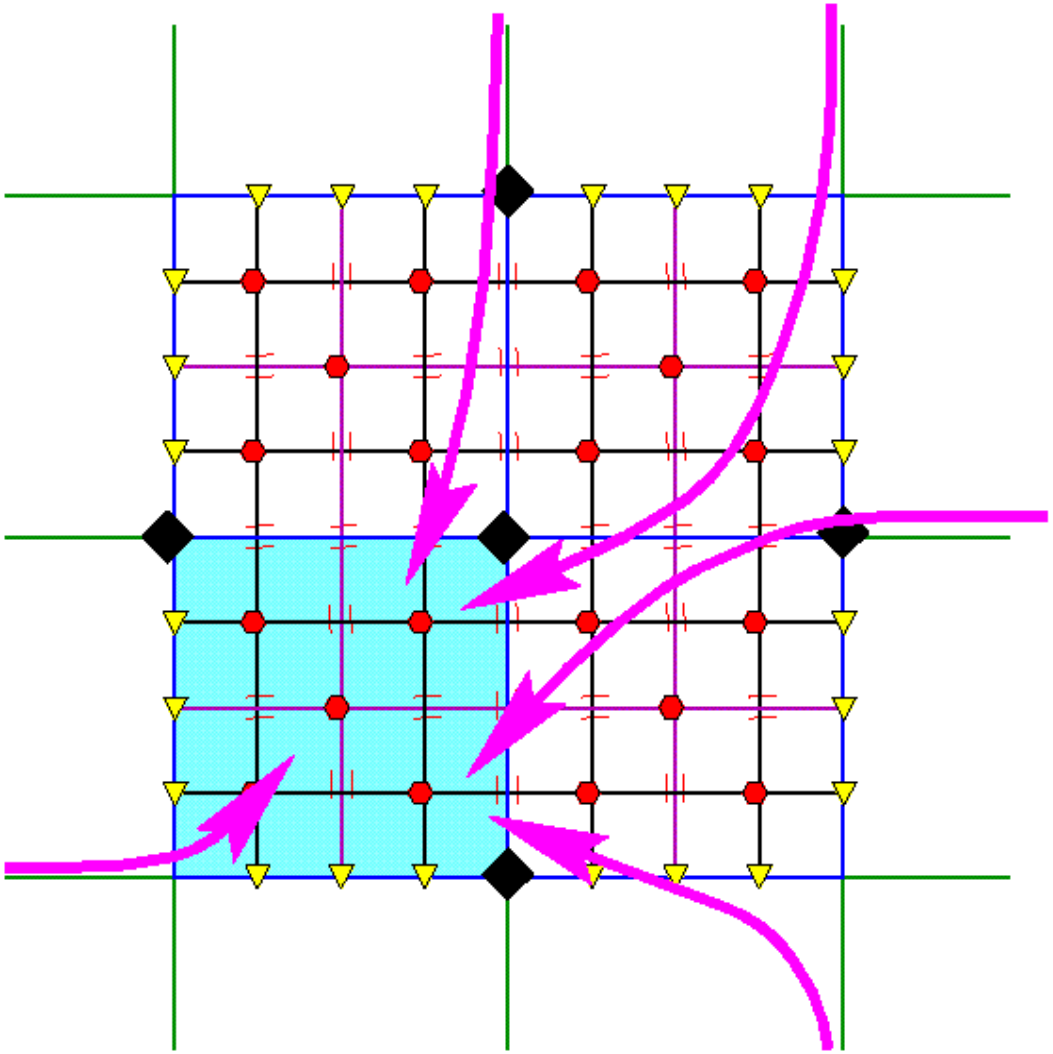
When Vehicles Decelerate in TRANSIMS

1. Random deceleration
2. Causal deceleration
   a. when the gap is too small
      - during forward movements
      - when trying to change lanes
   b. traffic control

Definition of Deceleration Events

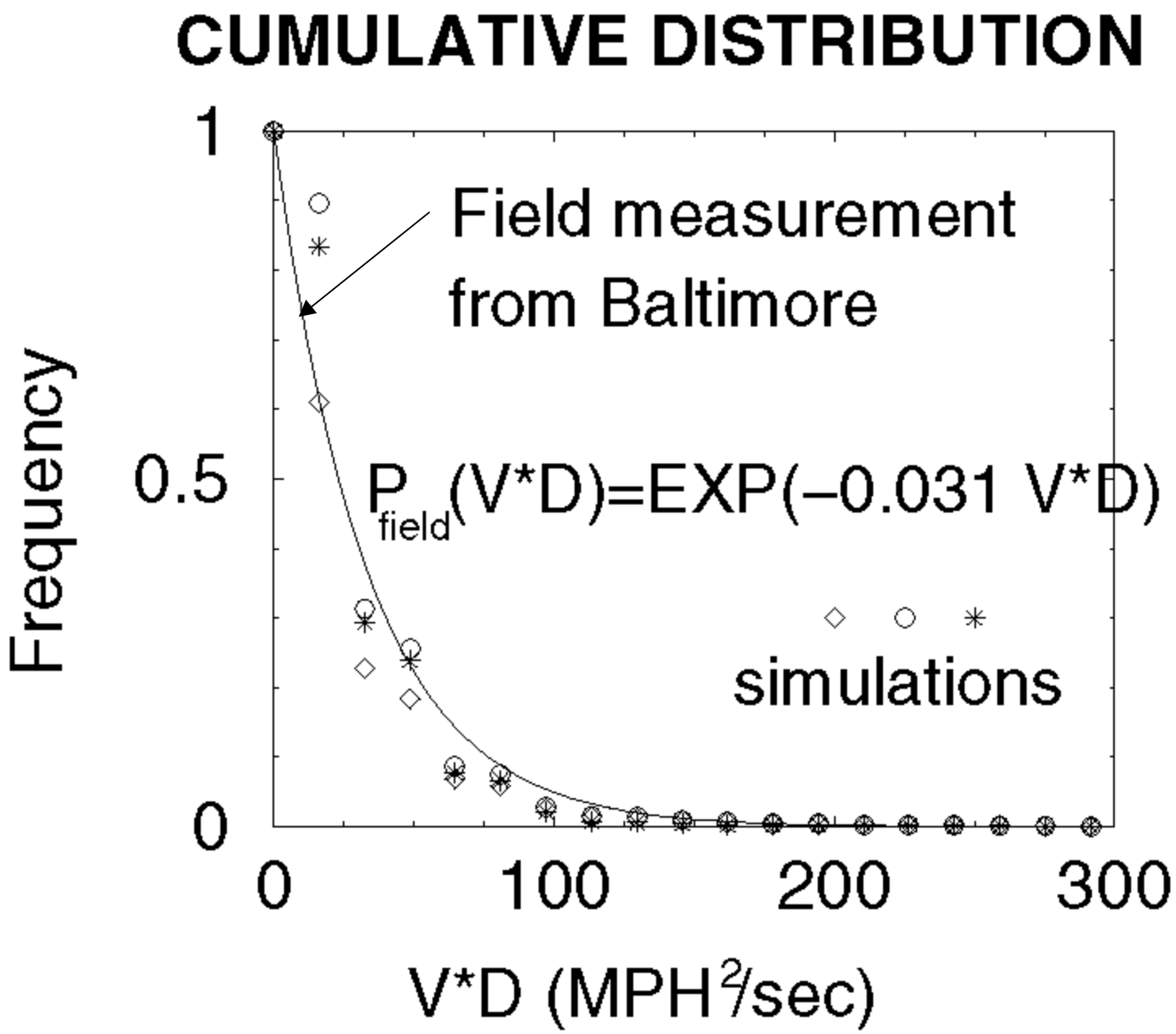


A Calibration Network and a Scenario



various kinds
of traffic controls

various kinds
of roads


CUMULATIVE DISTRIBUTION
1
0.5
0
Frequency
Field measurement
from Baltimore
P field (V*D)=EXP(–0.031 V*D)
simulations
0
100
200
300
V*D (MPH2/sec)

Probability of Accident

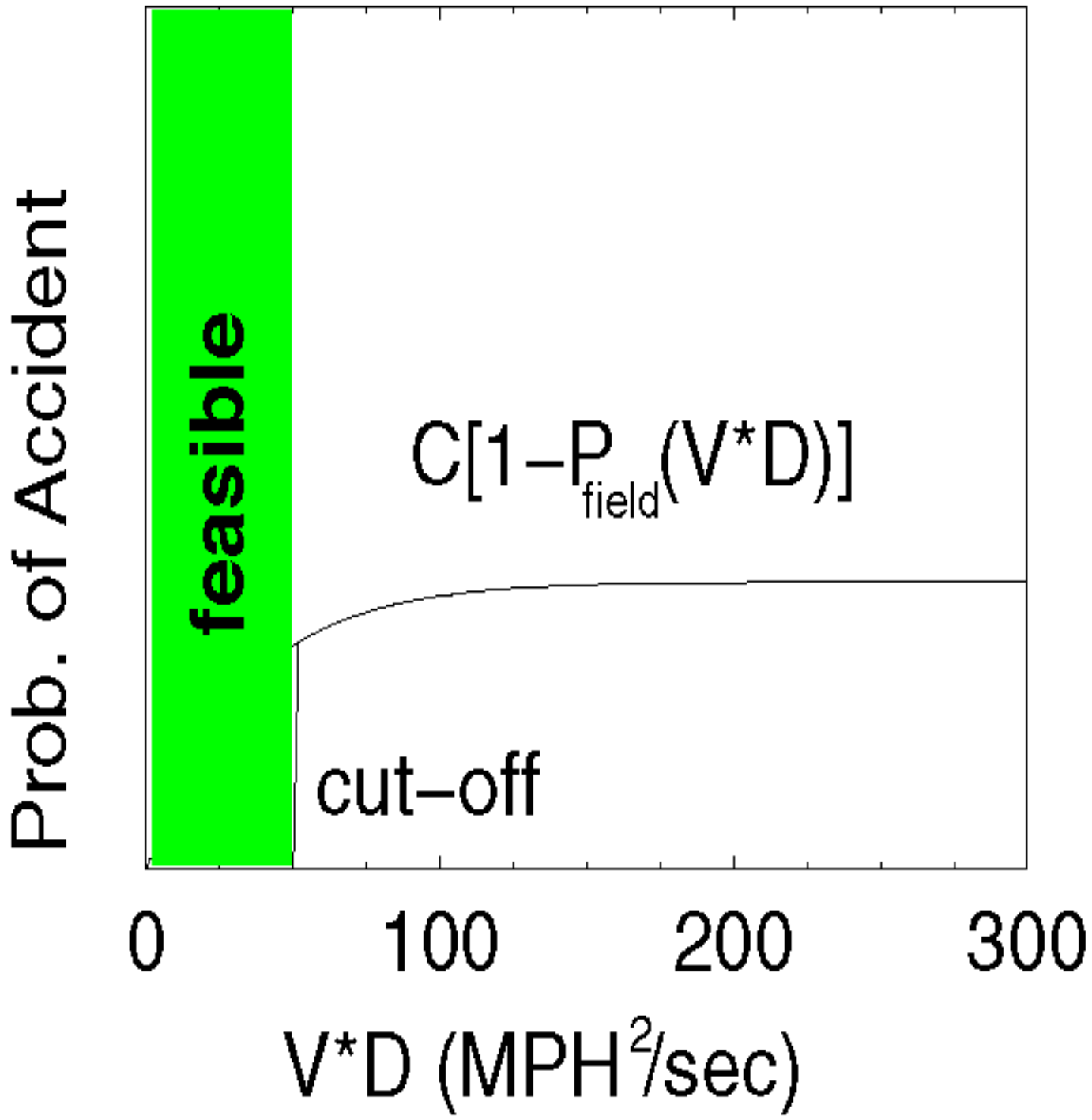
- In extreme deceleration events, the probability of accident depends only on the braking power.

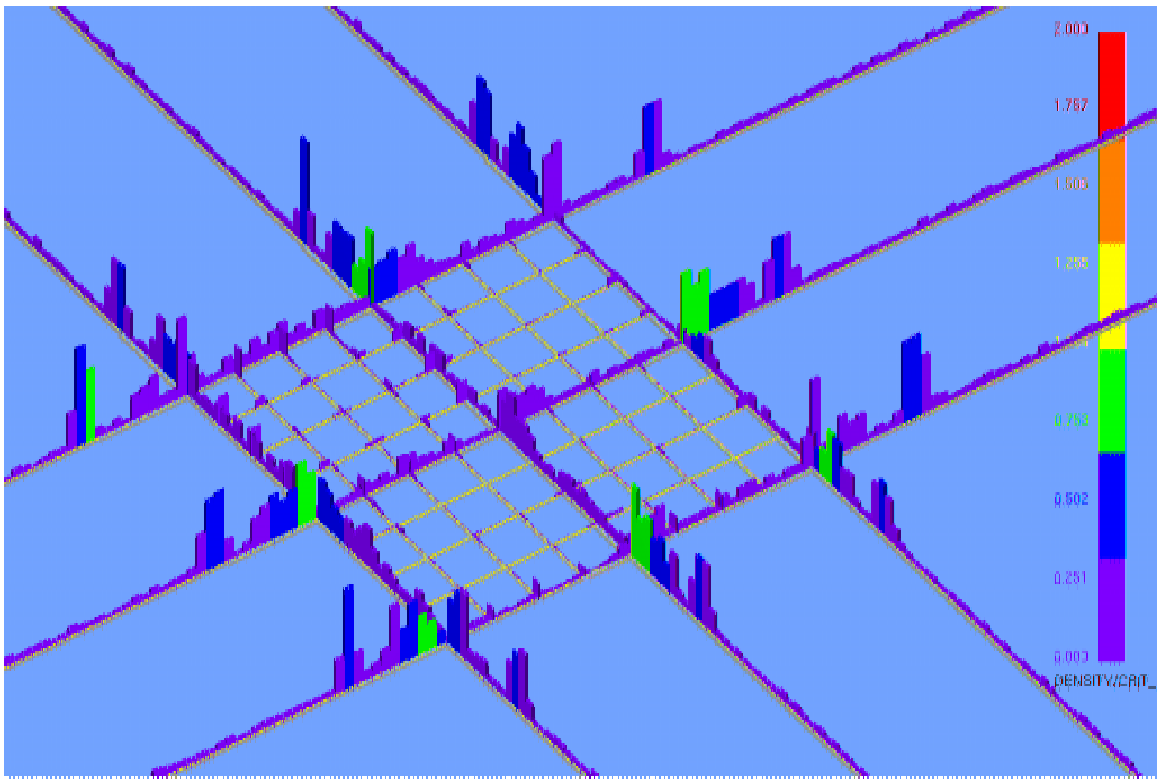
- Our postulate

(probability of an accident)

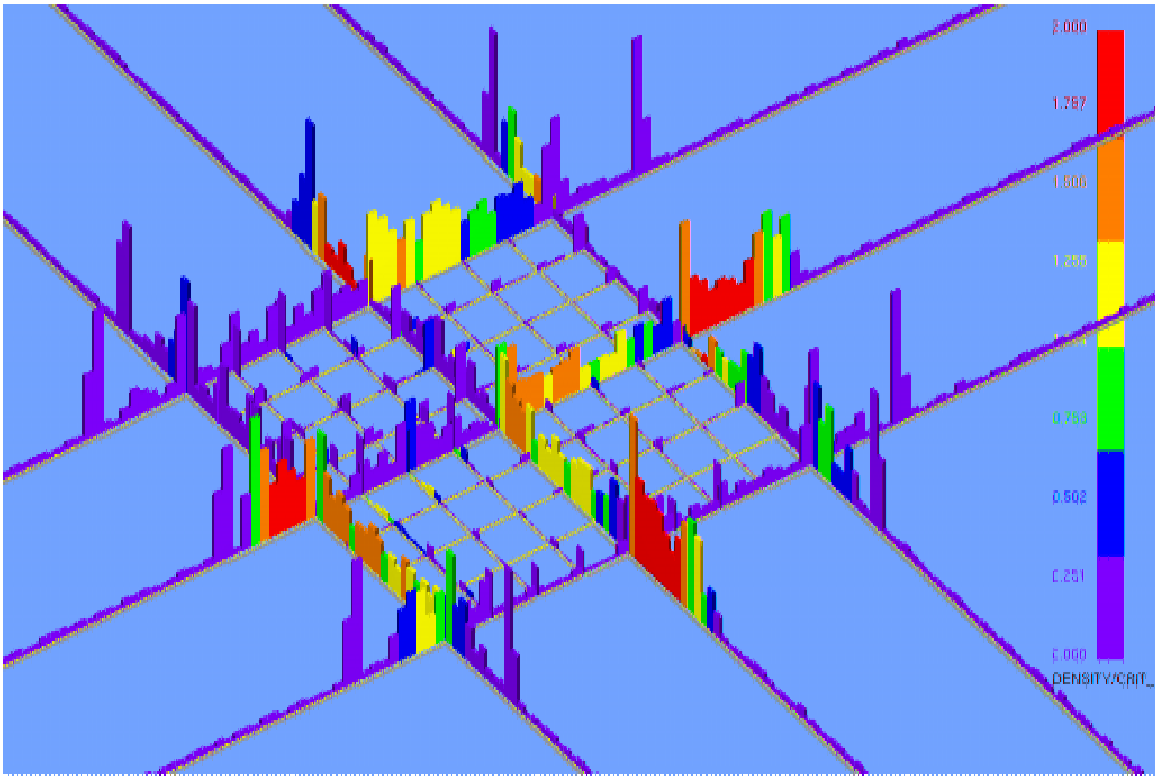
$\propto$ (prob. of not being able to decelerate)

$\propto$ $(1-P_{Field}(V*D))$

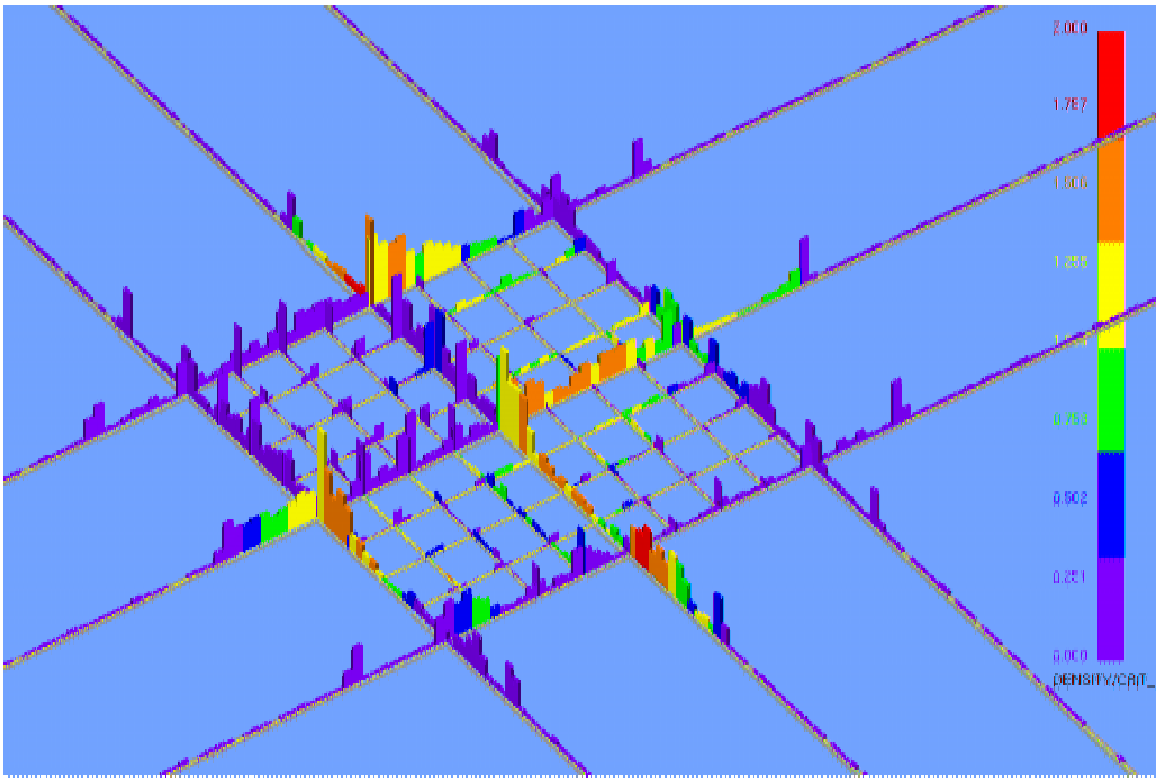

Prob. of Accident
feasible
C[1–P_field(V*D)]
cut–off
0
100
200
300
V*D (MPH²/sec)



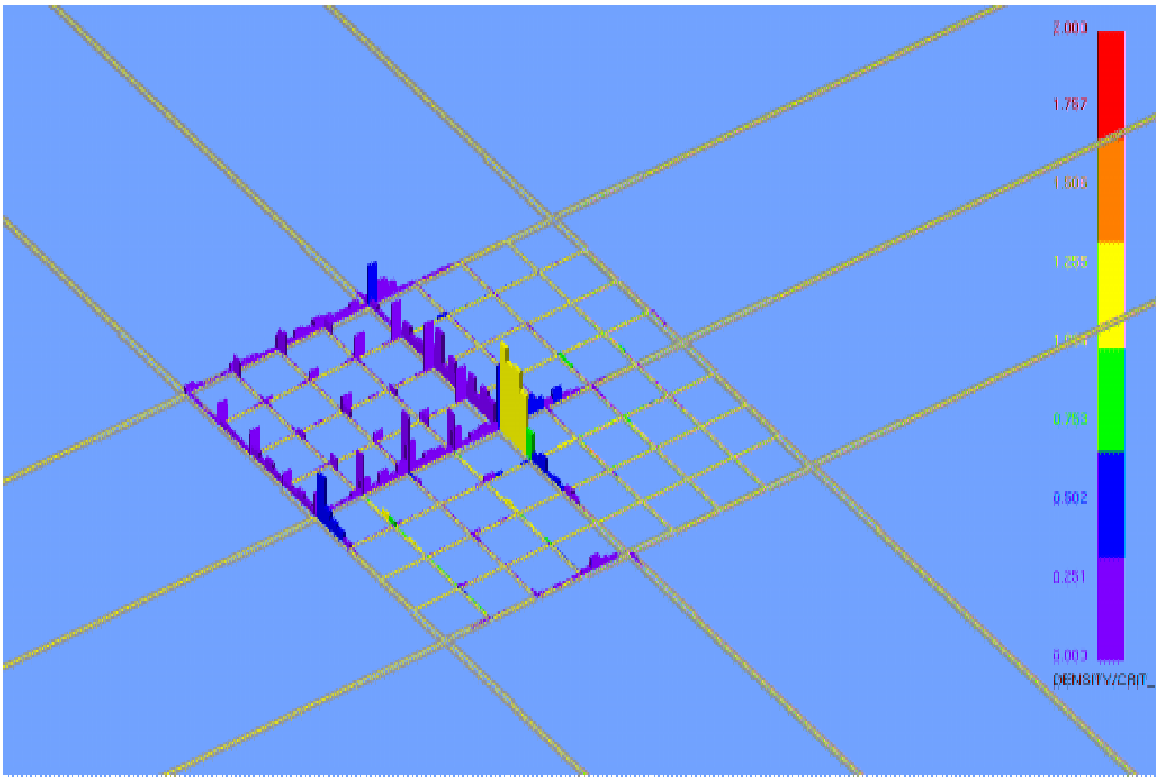
1-15 minutes



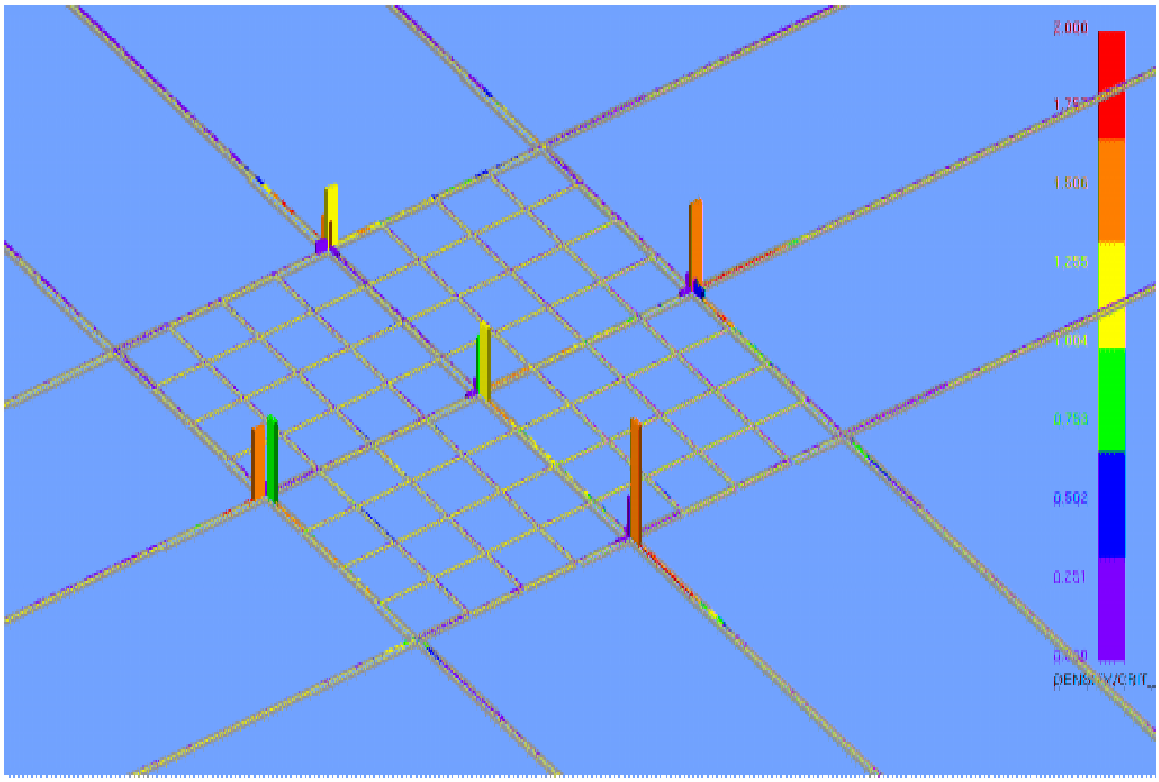
16-30 minutes



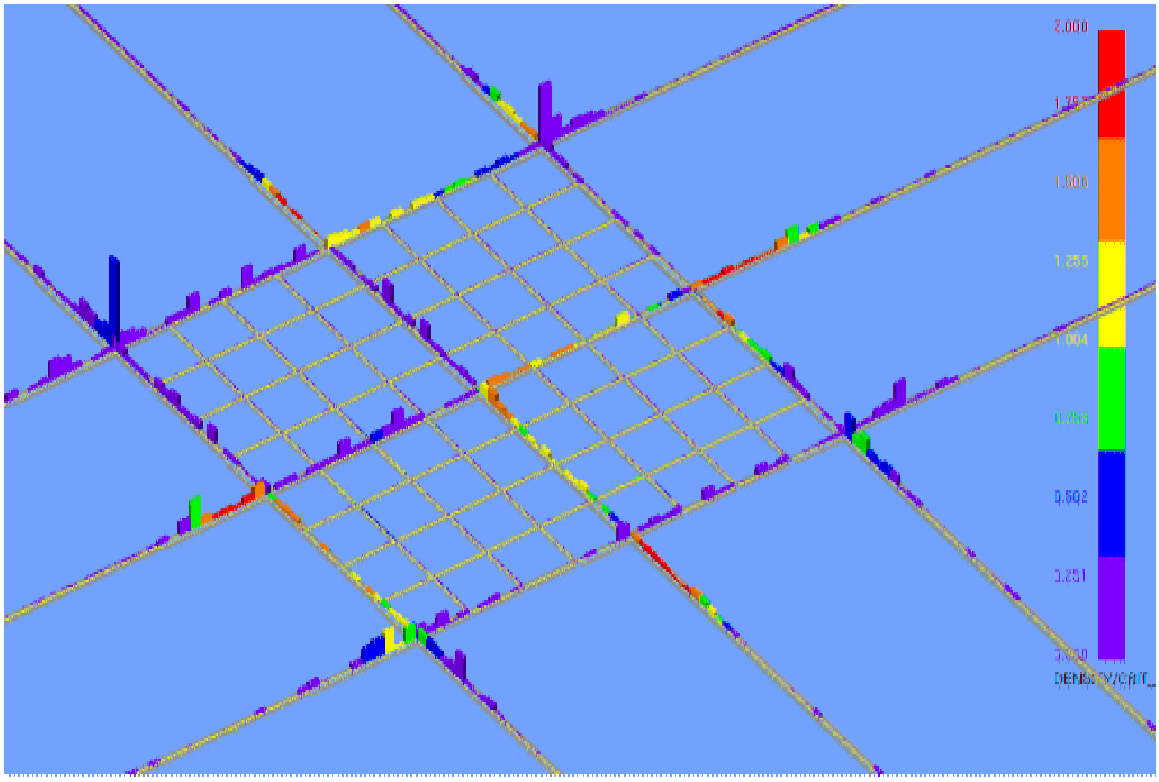
31-45 minutes



46-60 minutes



Intersection (signalized) accidents



Lane-changing accidents

Conclusions

- Our method using TRANSIMS outputs generates verifiable accident likelihood by time, by link, and by type.
- Field data shows good match of simulated deceleration behaviors to measured.
- The method can be elaborated and tuned.